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(54) **RECEPTACLE ASSEMBLY HAVING ANGLED RECEPTACLE GUIDE FRAMES**

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CPC ***H01R 24/76*** (2013.01); ***H01R 13/659*** (2013.01)
USPC **439/540.1**

(58) **Field of Classification Search**
USPC 439/540.1, 607.21, 541.5
See application file for complete search history.

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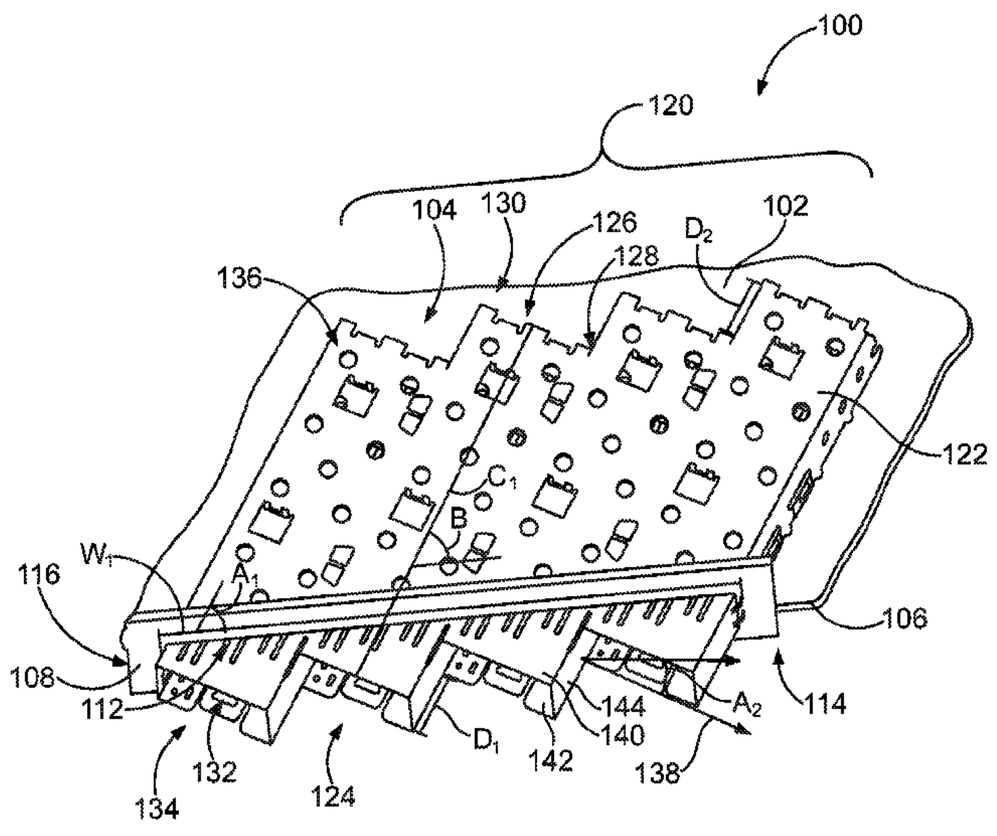
Primary Examiner — Neil Abrams

(57) **ABSTRACT**

A receptacle assembly includes multiple receptacle guide frames configured to be coupled to a host board. Each receptacle guide frame has a front end and a back end. A receptacle extends from the front end to the back end of each receptacle guide frame. Each receptacle has an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame. Each receptacle guide frame is configured to be aligned with an opening in a panel so that the receptacle is accessible through the opening. A host board connector is positioned at the closed end of each receptacle. Each host board connector includes a mating face. Each receptacle guide frame is aligned with the opening in the panel so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the panel.

20 Claims, 6 Drawing Sheets



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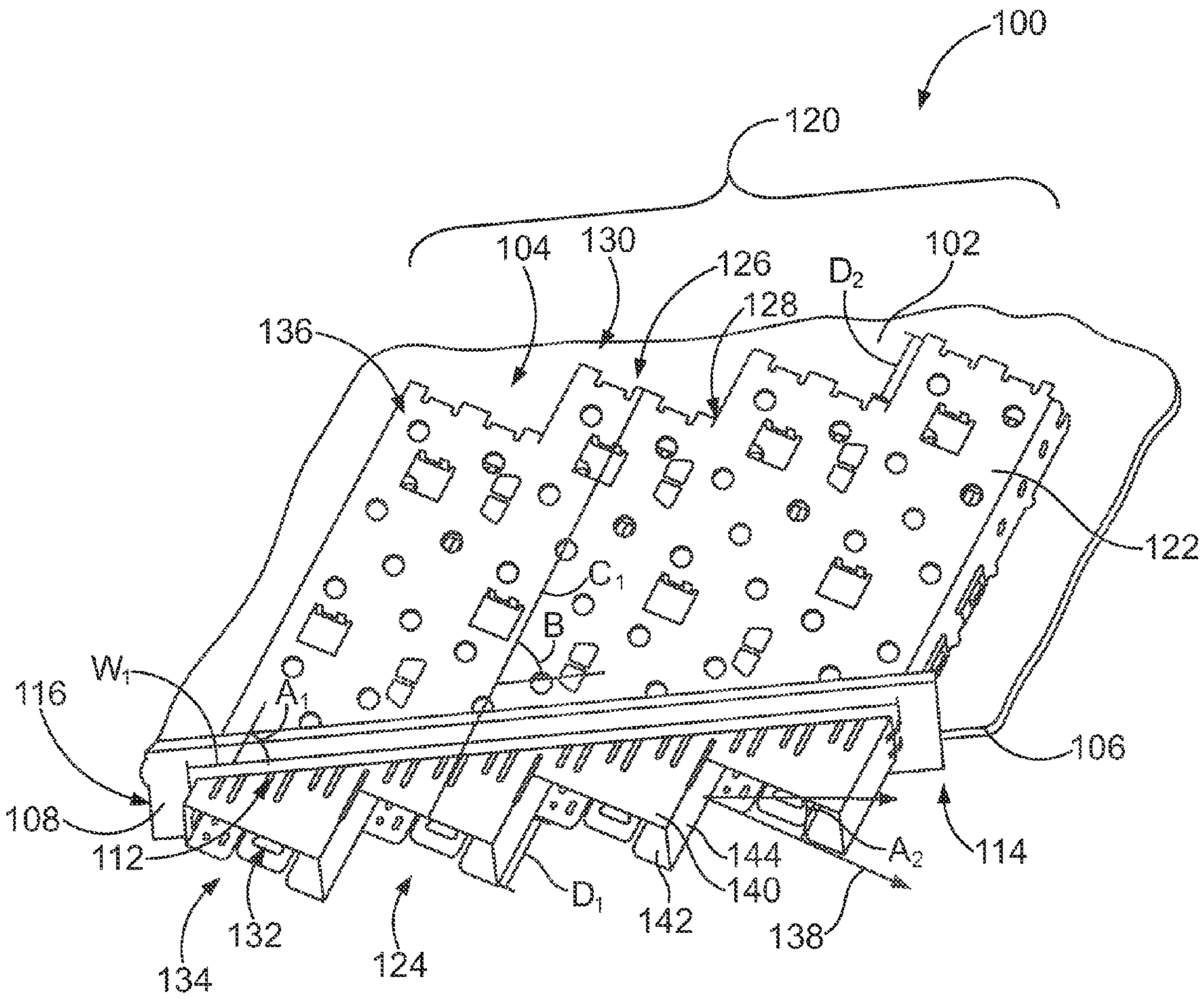
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124
134

FIG. 1

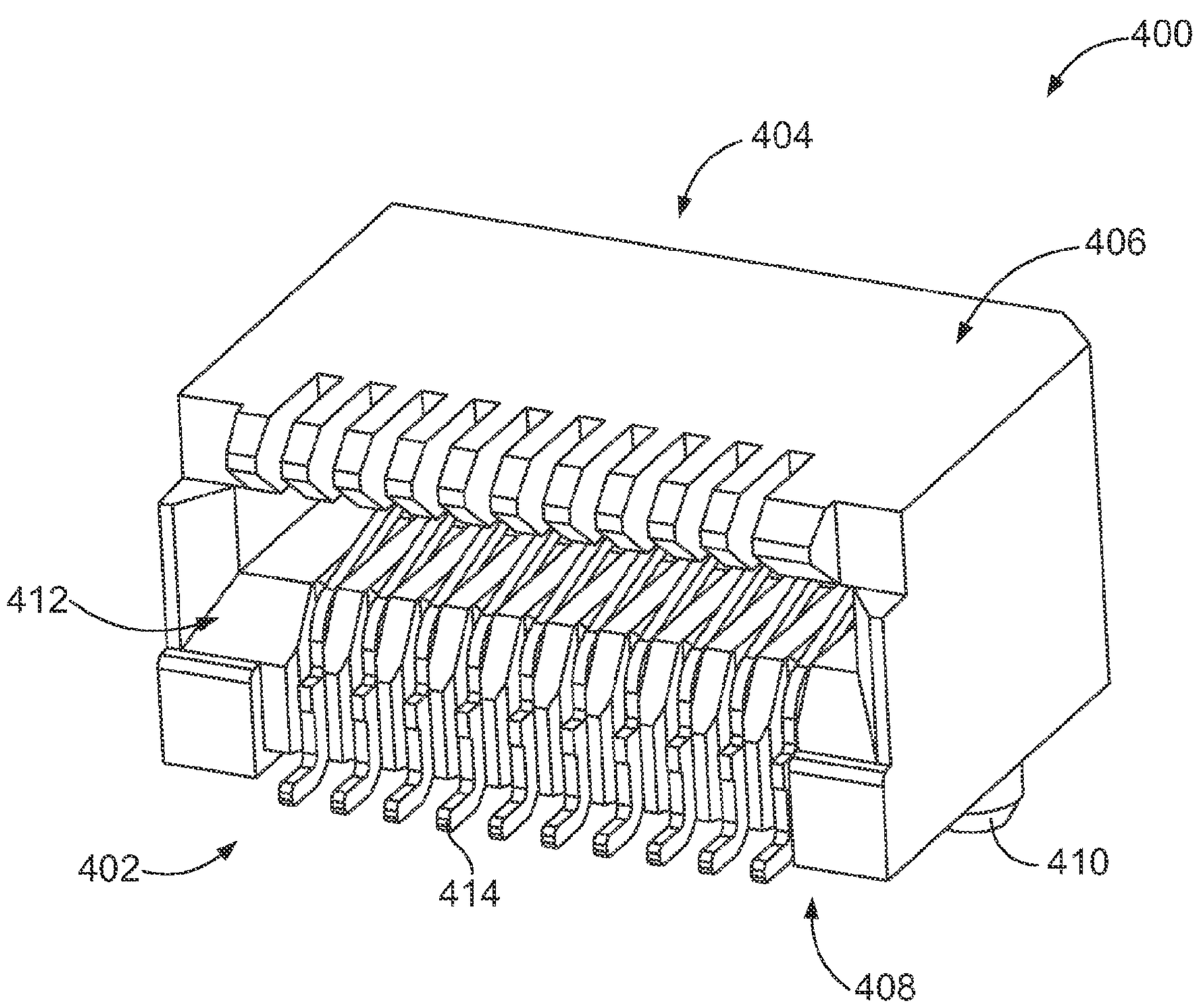


FIG. 2

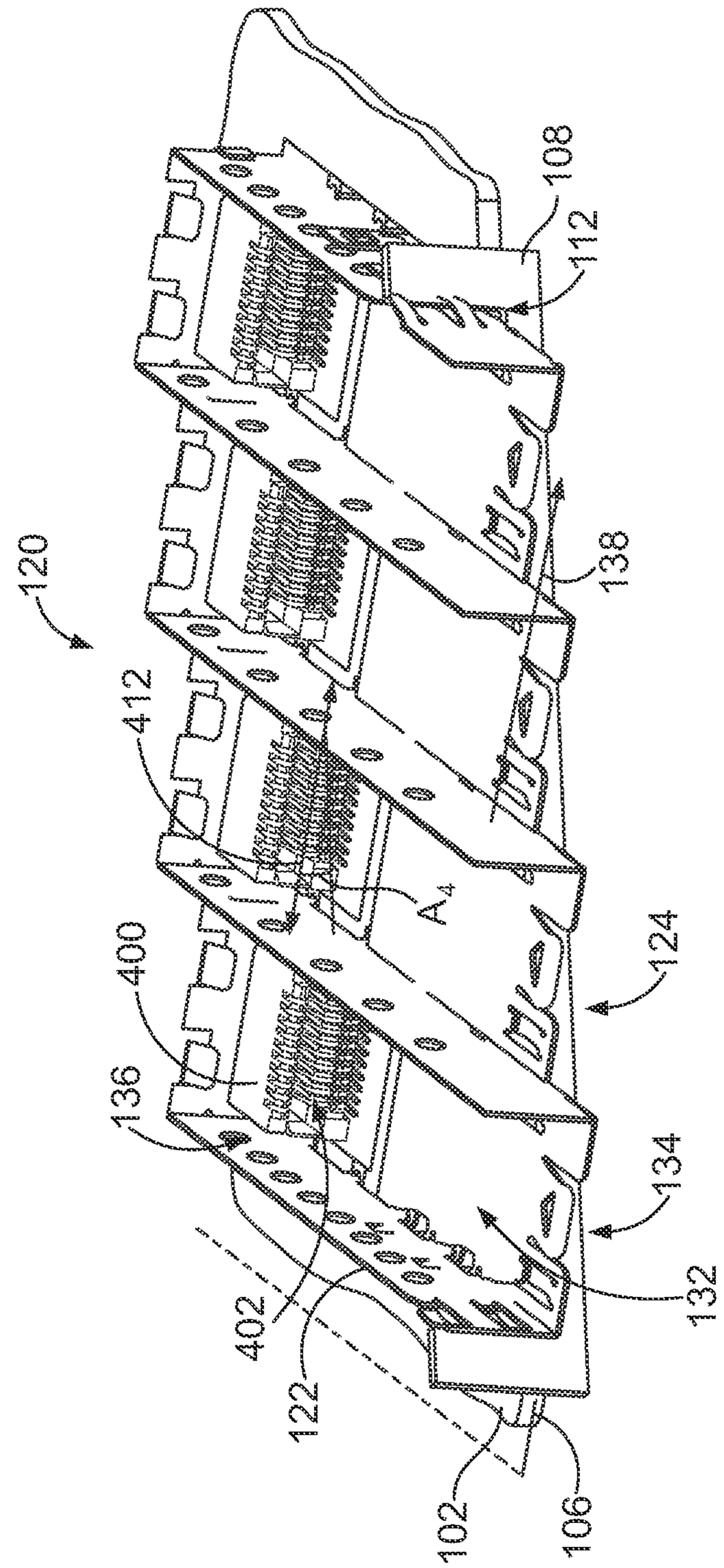
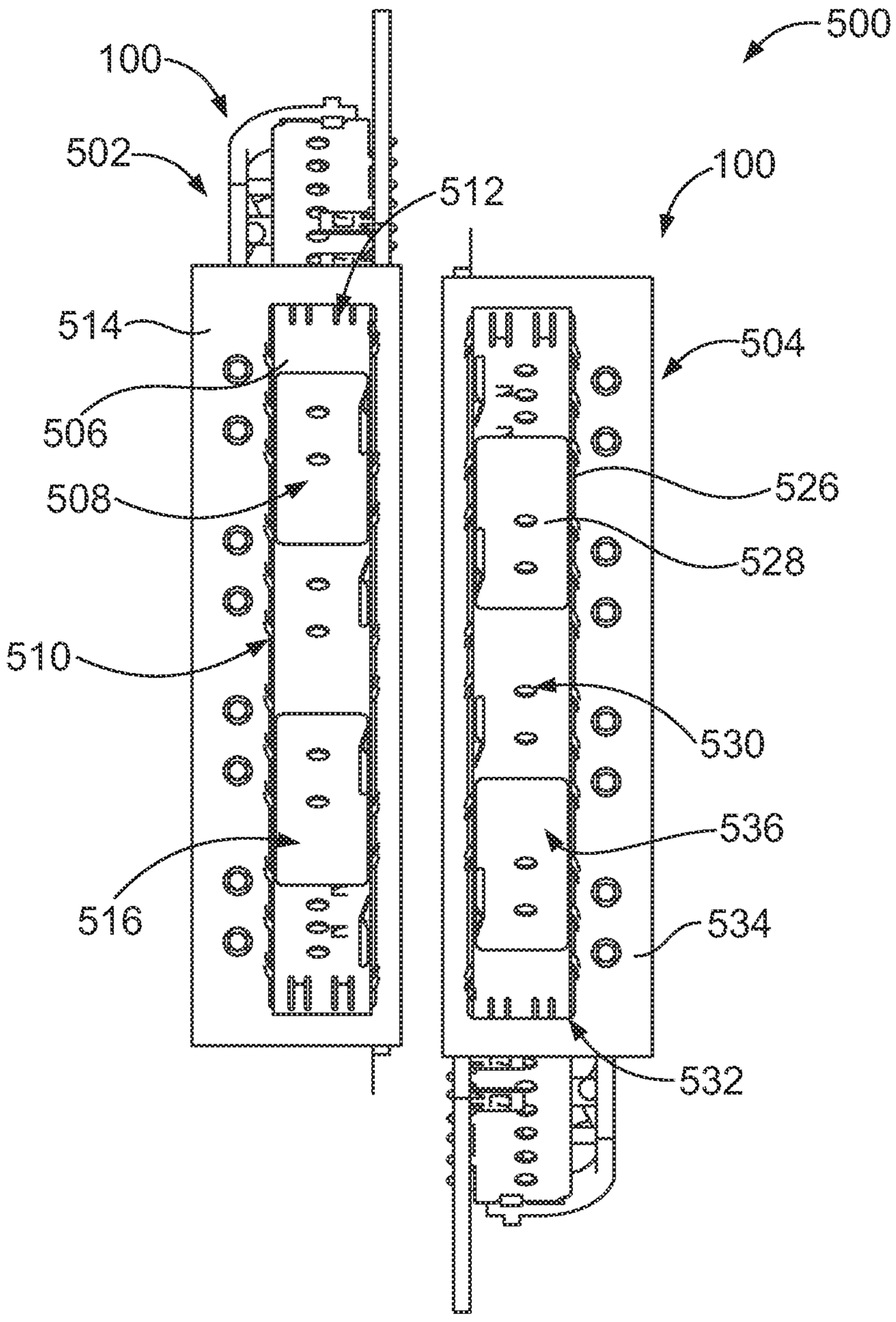


FIG. 3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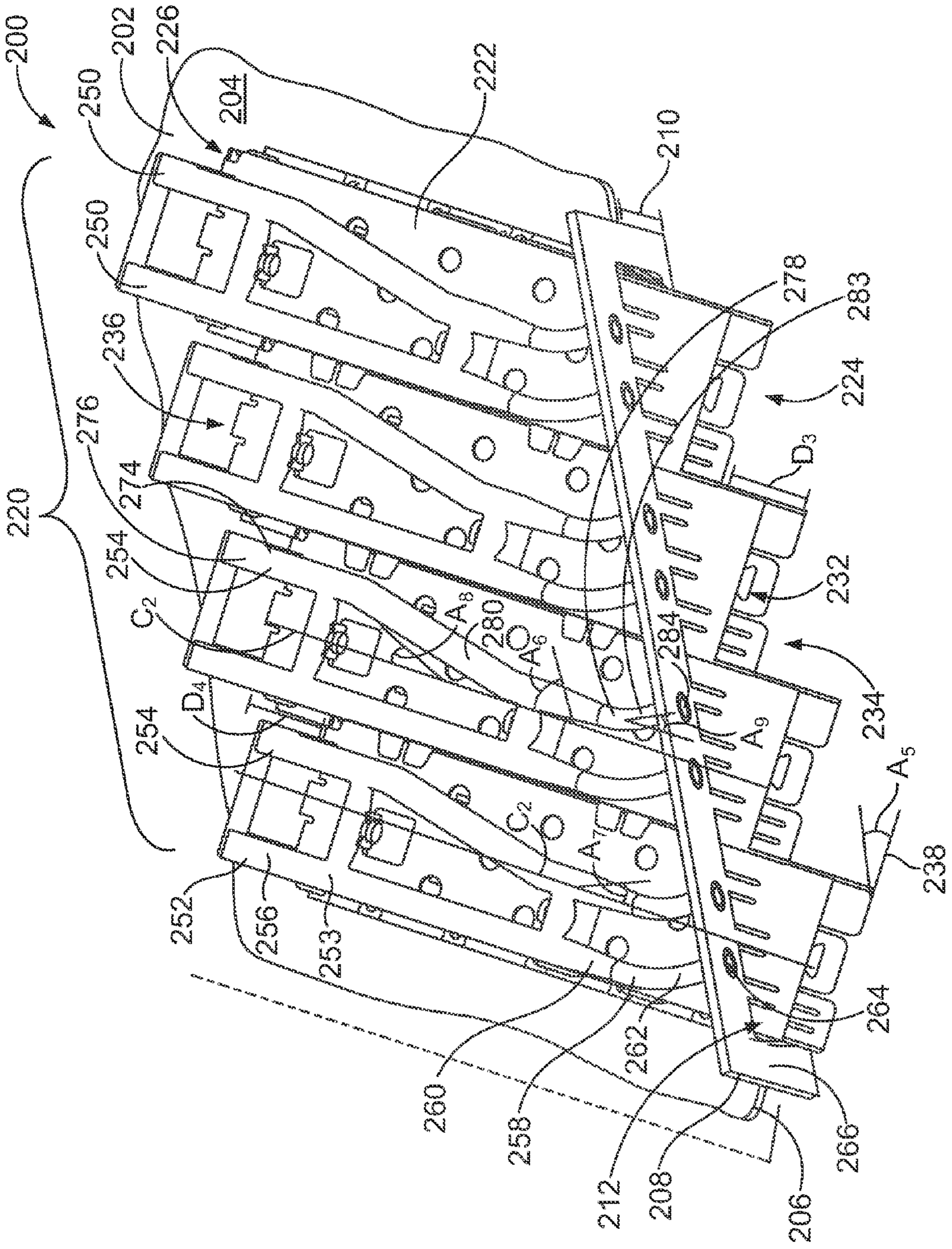
532

FIG. 4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D_4
234
254
A_9
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C_2
A_7
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208
206
266

FIG. 5

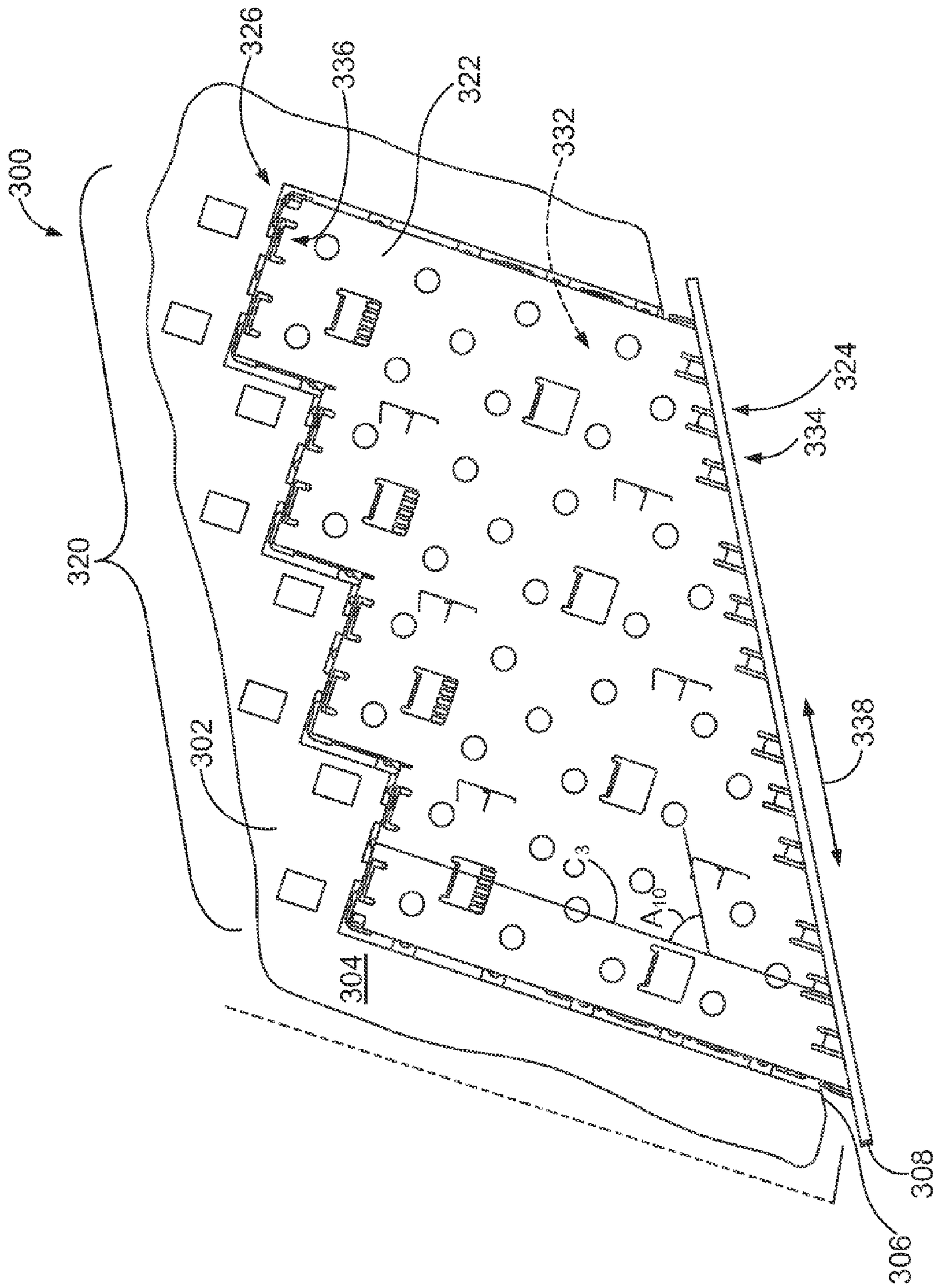

FIG. 6

RECEPTACLE ASSEMBLY HAVING ANGLED RECEPTACLE GUIDE FRAMES

BACKGROUND OF THE INVENTION

The subject matter described herein relates generally to receptacle assemblies, and more particularly, to receptacle assemblies having angled receptacle guide frames.

Electrical assemblies generally include a host board that is positioned adjacent to a panel within a chassis. The panel includes an opening that enables access to the host board. In particular, the host board may include a receptacle assembly coupled thereto. The receptacle assembly includes receptacle guide frames having host board connectors that electrically couple to the host board. The host board connectors may be copper-based connectors, fiber optic connectors, or the like. The receptacle guide frames extend through the opening in the panel so that the host board connectors may receive a plug, jack, or module that electrically couples a peripheral device to the host board.

Generally, the receptacle assembly includes multiple receptacle guide frames that each define a receptacle. The receptacles have an open end and a closed end. The host board connectors are positioned at the closed ends of the receptacles and are accessible through the open ends of the receptacles. The receptacle guide frames are coupled to the host board so that the open end of each receptacle extends through the opening in the panel. The receptacle guide frames are positioned so that the open end of each receptacle extends parallel to the panel. Some receptacle assemblies may also include a light pipe coupled to each receptacle guide frame and extending through the panel. The light pipe provides a signal indicative of an electrical connection to the host board connector and/or traffic through the host board connector.

However, conventional receptacle assemblies are not without their disadvantages. Generally, the receptacle assemblies are positioned in racks including several receptacle assemblies. Accordingly, several cables are connected to the electrical assembly. As such, cable management may be become difficult when making electrical connections with the electrical assembly. Often, cables from peripheral devices that have been connected to a host board connector may block other receptacles in the electrical assembly. Additionally, the cables may block the light pipes of other receptacle guide frames thereby preventing visual confirmation of the electrical connection and/or traffic through the host board connectors. The configuration of the receptacle assemblies may result in improper connections made between the cables and the electrical assembly and/or may increase the time required to couple peripheral devices to the electrical assembly.

A need remains for a connector assembly that improves the cable management of cables connected to the electrical assembly.

SUMMARY OF THE INVENTION

In one embodiment, a receptacle assembly is provided. The assembly includes multiple receptacle guide frames arranged adjacent to one another. The receptacle guide frames are configured to be coupled to a host board. Each receptacle guide frame has a front end and a back end. A receptacle extends from the front end to the back end of each receptacle guide frame. Each receptacle has an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame. Each receptacle guide frame is configured to be aligned with an opening in a panel so that the receptacle is accessible through the opening. A host board connector is positioned at the closed end of each receptacle. Each host board connector includes a mating face. Each receptacle guide frame is aligned with the opening in the panel so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the panel.

In another embodiment, an electrical assembly is provided. The electrical assembly includes a host board having an outer edge configured to be positioned adjacent to a panel. Multiple receptacle guide frames are arranged adjacent to one another. The receptacle guide frames are coupled to the host board. Each receptacle guide frame has a front end and a back end. A receptacle extends from the front end to the back end of each receptacle guide frame. Each receptacle has an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame. A host board connector is positioned at the closed end of each receptacle. Each host board connector includes a mating face. Each receptacle guide frame is coupled to the host board so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the outer edge of the host board.

In another embodiment, an electrical assembly is provided. The assembly includes a host board having an outer edge. A panel is positioned adjacent to the outer edge of the host board. The panel has an opening extending therethrough. Multiple receptacle guide frames are arranged adjacent to one another. The receptacle guide frames are coupled to the host board. Each receptacle guide frame has a front end and a back end. A receptacle extends from the front end to the back end of each receptacle guide frame. Each receptacle has an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame. A host board connector is positioned at the closed end of each receptacle. Each host board connector includes a mating face. Each receptacle guide frame is coupled to the host board so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the panel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top perspective view of an electrical assembly formed in accordance with an embodiment.

FIG. **2** is a front perspective view of a host board connector formed in accordance with an embodiment.

FIG. **3** is a cut-away view of the electrical assembly shown in FIG. **1** and having host board connectors shown in FIG. **2** positioned therein.

FIG. **4** is a front view of a rack formed in accordance with an embodiment.

FIG. **5** is a top perspective view of an electrical assembly formed in accordance with another embodiment.

FIG. **6** is a top view of an electrical assembly formed in accordance with another embodiment.

DETAILED DESCRIPTION OF THE INVENTION

The foregoing summary, as well as the following detailed description of certain embodiments will be better understood when read in conjunction with the appended drawings. As used herein, an element or step recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural of said elements or steps, unless such exclusion is explicitly stated. Furthermore, references to "one embodiment" are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate

the recited features. Moreover, unless explicitly stated to the contrary, embodiments "comprising" or "having" an element or a plurality of elements having a particular property may include additional such elements not having that property.

FIG. **1** is a top perspective view of an electrical assembly **100** formed in accordance with an embodiment. The electrical assembly **100** may be part of an equipment rack that includes multiple electrical assemblies **100**. The electrical assembly **100** includes a host board **102**. The host board **102** may be a circuit board, a printed circuit board, or the like. The host board **102** may be a motherboard, daughter card, backplane, midplane, or the like. The host board **102** includes a top surface **104** configured to have electrical components coupled thereto. The host board **102** includes an outer edge **106**. The top surface **104** extends from the outer edge **106** to a back edge (not shown). The top surface **104** also extends between side edges (not shown) that extend between the outer edge **106** and the back edge.

A panel **108** extends parallel to the outer edge **106** of the host board **102**. The panel **108** may be a bezel or the like. The panel **108** may be part of a chassis within a rack system of a network server or switch. In the illustrated embodiment, the panel **108** is spaced a distance from the outer edge **106** of the host board **102**. Optionally, the panel **108** may abut the outer edge **106** of the hostboard **102**. The panel **108** includes an opening **112** extending therethrough. The opening **112** is aligned above the top surface **104** of the host board **102**. The opening **112** provides access to the electrical components coupled to the top surface **104** of the host board **102**. The opening **112** extends a width W_1 between a first side **114** and a second side **116** of the panel **108**. The opening **112** may extend any distance between the first side **114** and the second side **116** of the panel **108**. The opening **112** may be configured to receive electrical components, cables, or the like therethrough.

A receptacle assembly **120** is coupled to the top surface **104** of the host board **102**. The receptacle assembly **120** includes multiple receptacle guide frames **122** positioned adjacent to one another. Optionally, the multiple receptacle guide frames **122** may be ganged together to form a single unit that may be mounted to the host board **106** and into the panel **108** as a single component. The receptacle guide frames **122** may include common stamped metal sheets that form one or more walls of the guide frames **122**. For example, each of the guide frames **122** may share a common top cage **140** and/or bottom cage **142** with separator walls **144** therebetween.

Each receptacle guide frame has a front end **124** and a back end **126**. Each receptacle guide frame **122** has a first side **128** and a second side **130**. Each receptacle guide frame **122** is coupled to the top surface **104** of the host board **102**. The back end **126** of each receptacle guide frame **122** is positioned distally from the outer edge **106** of the host board **102**. The front end **124** of each receptacle guide frame **122** is positioned proximate to the outer edge **106** of the host board **102**. In the illustrated embodiment, the front end **124** of each receptacle guide frame **122** extends past the outer edge **106** of the host board **102**. The front end **124** of each receptacle guide frame **122** extends through the opening **112** in the panel **108**. The receptacle guide frames **122** collectively have a width that is approximately equal to the width W_1 of the opening **112** in the panel **108**. The collective width of the receptacle guide frames **122** is defined at an angle A_1 with respect to the front end **124** and the back end **126** of each receptacle guide frame **122**. The collective width of the receptacle guide frames **122** is defined as being parallel to the panel **108** and the outer edge **106** of the host board **102**. The collective width of the receptacle guide frames is defined so that the front end **124** of each receptacle guide frame **122** can be received through the opening **112** in the panel **108**.

Each receptacle guide frame **122** includes coupling mechanisms **133** positioned proximate to the front end **124** of the receptacle guide frame **122**. The coupling mechanisms **133** are configured to engage the panel **108** to secure the receptacle guide frame **122** to the panel **108**.

The front ends **124** of the receptacle guide frames **122** are arranged in a stepped configuration. The front ends **124** of the receptacle guide frames **122** are offset from one another. The front end **124** of each receptacle guide frame **122** is positioned a distance D_1 from the front end **124** of each adjacent receptacle guide frame **122**. The distance D_1 may be uniform between each adjacent receptacle guide frame **122**. Alternatively, the distance D_1 may vary between each adjacent receptacle guide frame **122**. The back end **126** of each receptacle guide frame **122** is positioned a distance D_2 from the back end **126** of each adjacent receptacle guide frame **122**. The distance D_2 may be uniform between each adjacent receptacle guide frame **122**. Alternatively, the distance D_2 may vary between each adjacent receptacle guide frame **122**. In the illustrated embodiment, the distance D_2 is equal to the distance D_1.

The front end **124** of each receptacle guide frame **122** extends in a plane **138**. Optionally, the plane **138** defined by each receptacle guide frame **122** may be parallel to the plane **138** defined by the other receptacle guide frames **122**. Alternatively, the planes **138** may be at different angles. The plane **138** defined by each receptacle guide frame **122** extends at a non-orthogonal angle A_2 with respect to the outer edge **106** of the host board **102**. The plane **138** defined by each receptacle guide frame **122** also extends at the angle A_2 with respect to the panel **108**. The front ends **124** of the receptacle guide frames **122** are angled with respect to the panel **108** and the outer edge **106** of the host board **102** to facilitate cable management when connecting cables to the receptacle guide frames **122**.

Each receptacle guide frame **122** is elongated along a central axis C_1 defined between the front end **124** and the back end **126** of the receptacle guide frame **122**. The central axes C_1 of the receptacle guide frames **122** are perpendicular to the planes **138** defined by the front end **124** of each receptacle guide frame **122**. The central axes C_1 extend at a non-orthogonal angle B with respect to the outer edge **106** of the host board **102**. The central axes C_1 also extend at the angle B with respect to the panel **108**. The central axes C_1 of the receptacle guide frames **122** are angled with respect to the panel **108** and the outer edge **106** of the host board **102** to facilitate cable management when connecting cables to the receptacle guide frames **122**.

Each receptacle guide frame **122** includes a receptacle **132**. The receptacles **132** extend between the front end **124** and the back end **126** of the respective receptacle guide frame **122**. The receptacles **132** include an open end **134** positioned at the front end **124** of the receptacle guide frame **122**. The receptacles **132** include a closed end **136** positioned at the back end **126** of the receptacle guide frame **122**. The open end **134** of each receptacle **132** extends through the opening **112** in the panel **108**.

FIG. **2** is a front perspective view of a host board connector **400** formed in accordance with an embodiment. The host board connector **400** includes a mating end **402** and a rear end **404**. A top **406** and a bottom **408** extend between the mating end **402** and the rear end **404**. The host board connector **400** is configured to be positioned in a receptacle **132** (shown in FIG. **1**). The bottom **408** of the host board connector **400**

includes pins **410** extending therefrom. The pins **410** are configured to be received in openings formed in the receptacle guide frame **122** (shown in FIG. **1**) to secure the host board connector **400** in the receptacle guide frame **122**. In one embodiment, the pins **410** may also be received in apertures formed in the host board **102** to secure the host board connector **400** to the host board **102**.

The mating end **402** of the host board connector **400** forms a mating face **412**. Contacts **414** extend along the mating face **412**. The connector **400** is configured to electrically couple to the host board **102** so that the contacts **414** are electrically coupled to the host board **102**. The contacts **414** may be configured to receive copper-based connectors, fiber optic connectors, or the like. In one embodiment, the contacts **414** are configured to receive contacts of a module (not shown) that is received in the receptacle **132**. The module may be a transceiver or the like. The module may be configured to receive cables or the like from peripheral devices. The connector **400** electrically couples the peripheral devices to the host board **102**.

FIG. **3** is a cut-away view of the receptacle assembly **120** having the host board connectors **400** positioned therein. The host board connectors **400** are positioned at the closed end **136** of the receptacle **132**. The host board connectors **400** are positioned so that the mating end **402** of the host board connector **400** faces the open end **134** of the receptacle. The mating end **402** of the host board connector **400** is accessible through the open end **134** of the receptacle. The mating end **402** of the host board connector **400** is accessible through the opening **112** in the panel **108**.

The mating face **412** of each connector **400** is positioned proximate to the closed end **136** of the receptacle **132**. In an alternative embodiment, the connectors **400** may be positioned at the open end **134** of the receptacle **132** so that the mating face **412** extends past the front end **124** of the receptacle guide frame **122**. The mating face **412** extends parallel to the plane **138** defined by the front end **124** of the receptacle guide frame **122**. The mating face **412** extends perpendicular to the central axis C_1 of the receptacle guide frame **122**. The mating face **412** of each connector **400** extends at a non-orthogonal angle A_4 with respect to the outer edge **106** of the host board **102**. The mating face **412** of each connector **400** also extends at the angle A_4 with respect to the panel **108**. The mating face **412** of each connector **400** is angled with respect to the panel **108** and the outer edge **106** of the host board **102** to facilitate cable management when connecting cables to the connectors **400**. The connectors **400** and the receptacles **132** are angled so that cables connected to the connectors **400** do not block connectors **400** and receptacles **132** of neighboring electrical assemblies **100**.

FIG. **4** is a front view of a rack **500** including two electrical assemblies **100**. The rack **500** includes a first electrical assembly **502** and a second electrical assembly **504** positioned adjacent to the first electrical assembly **502**. The first electrical assembly **502** includes multiple receptacle guide frames **506** arranged in a column. Each receptacle guide frame **506** includes a receptacle **508** extending therethrough. The receptacle guide frames **506** include a front end **510** aligned with an opening **512** in a bezel **514**. The front end **510** of each receptacle guide frame **506** is angled downward at a non-orthogonal angle. Each receptacle **508** includes an open end **516** at the front end **510** of the receptacle guide frame **506**. The open end **516** of each receptacle **508** is angled downward.

The second electrical assembly **504** includes multiple receptacle guide frames **526** arranged in a column. Each receptacle guide frame **526** includes a receptacle **528** extending therethrough. The receptacle guide frames **526** include a front end **530** aligned with an opening **532** in a bezel **534**. The front end **530** of each receptacle guide frame **526** is angled upward a non-orthogonal angle. The front end **530** of each receptacle guide frame **526** is angled opposite the angle of the front ends **510** of the receptacle guide frames **506** of the first electrical assembly **502**. Each receptacle **528** includes an open end **536** at the front end **530** of the receptacle guide frame **526**. The open end **536** of each receptacle **528** is angled upward. The open end **536** of each receptacle **528** is angled opposite the angle of the open end **516** of the receptacles **508** of the first electrical assembly **502**.

The electrical assemblies **100** include angled receptacle guide frames to facilitate cable management when coupling peripheral devices to the host board connectors. The receptacle guide frames are angled so that the cables coupled to the rack do not block the receptacles of neighboring electrically assemblies. It should be noted that the electrical assemblies **502** and **504** are illustrated as being angled in opposite directions. In one embodiment, the first electrical assembly **502** and the second electrical assembly **504** may each be angled upward. Optionally, the first electrical assembly **502** and the second electrical assembly **504** may each be angled downward. In one embodiment, the rack **500** includes any number of electrical assemblies **100** angled upward and/or downward.

FIG. **5** is a top perspective view of an electrical assembly **200** formed in accordance with another embodiment. The electrical assembly **200** includes a host board **202**. The host board **202** includes a top surface **204** configured to have electrical components coupled thereto. The host board **202** includes an outer edge **206**.

A panel **208** extends parallel to the outer edge **206** of the host board **202**. In the illustrated embodiment, the panel **208** is spaced a distance **210** from the outer edge **206** of the host board **202**. Optionally, the panel **208** may abut the outer edge **206** of the host board **202**. The panel **208** includes an opening **212** extending therethrough.

A receptacle assembly **220** is coupled to the top surface **204** of the host board **202**. The receptacle assembly **220** includes multiple receptacle guide frames **222** having a front end **224** and a back end **226**. Each receptacle guide frame **222** is coupled to the top surface **204** of the host board **202**. The back end **226** of each receptacle guide frame **222** is positioned distally from the outer edge **206** of the host board **202**. The front end **224** of each receptacle guide frame **222** is positioned proximate to the outer edge **206** of the host board **202**. In the illustrated embodiment, the front end **224** of each receptacle guide frame **222** extends past the outer edge **206** of the host board **202**. The front end **224** of each receptacle guide frame **222** extends through the opening **212** in the panel **208**. The front end **224** of each receptacle guide frame **222** extends past the opening **212** in the panel **208**.

Each receptacle guide frame **222** includes a receptacle **232** extending between the front end **224** and the back end **226** of the receptacle guide frame **222**. The receptacles **232** include an open end **234** positioned at the front end **224** of the receptacle guide frame **222**. The receptacles **232** include a closed end **236** positioned at the back end **226** of the receptacle guide frame **222**. The open end **234** of each receptacle **232** extends through the opening **212** in the panel **208**. The open end **234** of each receptacle **232** extends past the opening **212** in the panel **208**.

The front ends **224** of the receptacle guide frames **222** are arranged in a stepped configuration. The front end **224** of each receptacle guide frame **222** is positioned a distance D_3 from the front end **224** of each adjacent receptacle guide frame **222**. The distance D_3 may be uniform between each adjacent

receptacle guide frame **222**. Alternatively, the distance D_3 may vary between each adjacent receptacle guide frame **222**. The back end **226** of each receptacle guide frame **222** is positioned a distance D_4 from the back end **226** of each adjacent receptacle guide frame **222**. The distance D_4 may be uniform between each adjacent receptacle guide frame **222**. Alternatively, the distance D_4 may vary between each adjacent receptacle guide frame **222**. In the illustrated embodiment, the distance D_4 is equal to the distance D_3.

The front end **224** of each receptacle guide frame **222** extends in a plane **238**. The plane **238** defined by each receptacle guide frame **222** is parallel to the plane **238** defined by the other receptacle guide frames **222**. The plane **238** defined by each receptacle guide frame **222** extends at a non-orthogonal angle A_5 with respect to the outer edge **206** of the host board **202** and the panel **208**. The front ends **224** of the receptacle guide frames **222** are angled with respect to the panel **208** and the outer edge **206** of the host board **202** to facilitate cable management when connecting cables to the receptacle guide frame **222**.

Each receptacle guide frame **222** includes a central axis C_2. The central axis C_2 extends between the front end **224** and the back end **226** of the receptacle guide frame **222**. The central axes C_2 are perpendicular to the planes **238** defined by the front end **224** of each receptacle guide frame **222**. The central axes C_2 extend at a non-orthogonal angle A_6 with respect to the outer edge **206** of the host board **202** and the panel **208**. The central axes C_2 of the receptacle guide frames **222** are angled with respect to the panel **208** and the outer edge **206** of the host board **202** to facilitate cable management when connecting cables to the receptacle guide frames **222**.

The electrical assembly **200** includes light pipes **250** extending over each receptacle guide frame **222**. The light pipes **250** are configured to direct lighting signals indicative of a connection with the receptacle assembly **220** and/or traffic, for example data and/or power signals, through the receptacle assembly **220**. In the illustrated embodiment, the light pipes **250** are configured in pairs that include a first light pipe **252** and a second light pipe **254**. A pair of light pipes **250** extends over each receptacle guide frame **222** of the receptacle assembly **220**. Optionally, the receptacle assembly **220** may include any number of light pipes **250**.

The first light pipe **252** includes a board portion **253**. A first end **256** of the board portion **253** is joined to the host board **202** proximate to the back end **226** of the receptacle guide frame **222**. The host board **202** includes a light source (not shown), for example, an LED that is coupled to the first end **256** of the board portion **253** of the first light pipe **252**. The board portion **253** of the first light pipe **252** extends over the receptacle guide frame **222** parallel to the central axis C_2. An intermediate portion **258** is joined to a second end **260** of the board portion **253** proximate to the front end **224** of the receptacle guide frame **222**. The intermediate portion **258** is bent at an angle. An end portion **262** of the first light pipe **252** extends from the intermediate portion **258** to the panel **208**. The end portion **262** extends perpendicular with respect to the panel **208**. The end portion **262** extends at a non-orthogonal angle A_7 with respect to the central axis C_2. The end portion **262** extends through the panel **208**. The end portion **262** includes an end surface **264** that is positioned flush with an outer surface **266** of the panel **208**. Alternatively, the end surface **264** may extend past the outer surface **266** of the panel **208** or be recessed with respect to the outer surface **266** of the panel **208**.

The second light pipe **254** includes a board portion **274**. A first end **276** of the board portion **274** is joined to the host board **202** proximate to the back end **226** of the receptacle guide frame **222**. The host board **202** includes a light source (not shown), for example, an LED that is coupled to the first end **276** of the board portion **274** of the second light pipe **254**. The first end **276** of the board portion **274** of the second light pipe **254** extends over the receptacle guide frame **222** parallel to the central axis C_2. A second end **280** of the board portion **274** extends at a non-orthogonal angle A_8 with respect to the central axis C_2. An intermediate portion **278** is joined to a second end **280** of the board portion **274** proximate to the front end **224** of the receptacle guide frame **222**. The intermediate portion **278** is bent at an angle. An end portion **283** of the second light pipe **254** extends from the intermediate portion **282** to the panel **208**. The end portion **283** extends perpendicular with respect to the panel **208**. The end portion **283** extends at a non-orthogonal angle A_9 with respect to the central axis C_2. The end portion **283** extends through the panel **208**. The end portion **283** includes an end surface **284** that is positioned flush with the outer surface **266** of the panel **208**. Alternatively, the end surface **284** may extend past the outer surface **266** of the panel **208** or be recessed with respect to the outer surface **266** of the panel **208**.

The end surfaces **264** and **284** of the first light pipe **252** and the second light pipe **254**, respectively, are positioned flush with the outer surface **266** of the panel **208** to facilitate providing visual confirmation of a connection with the receptacle assembly **220** and/or traffic through the receptacle assembly **220**. The front ends **224** of the receptacle guide frame **222** are angled with respect to the outer surface **266** of the panel **208** so that cables connected to the receptacle guide frame **222** do not interfere with and/or cover the end surfaces **264** and **284** of the first light pipe **252** and the second light pipe **254**, respectively.

The end surfaces **264** and **284** of the first light pipe **252** and the second light pipe **254**, respectively, are positioned above the receptacles **232**. A first light pipe **252** and a second light pipe **254** are positioned above each receptacle **232**. The light pipes **252** and **254** direct a light signal to the end surfaces **264** and **284** thereof. The light signal is indicative of an electrical connection to a host board connector (not shown) positioned in the receptacle **232**. The light signal may indicate that electrical signals are being transmitted through the host board connector. For example, the light signal may indicate that data and/or power signals are being transmitted through the host board connector between the host board **202** and a peripheral device. The receptacles **232** are angled with respect to the panel **208** so that cables connected to the host board connectors do not block the end surfaces **264** and **284** of the first light pipe **252** and the second light pipe **254**, respectively, of neighboring electrical assemblies **200**.

FIG. **6** is a top perspective view of an electrical assembly **300** formed in accordance with another embodiment. The electrical assembly **300** includes a host board **302** having a top surface **304** and an outer edge **306**. A panel **308** extends parallel to the outer edge **306** of the host board **302**. The panel **308** includes an opening (not shown) extending therethrough.

A receptacle assembly **320** is coupled to the top surface **304** of the host board **302**. The receptacle assembly **320** includes multiple receptacle guide frames **322** having a front end **324** and a back end **326**. The front end **324** of each receptacle guide frame **322** is positioned proximate to the outer edge **306** of the host board **302**. The front end **324** of each receptacle guide frame **322** is positioned behind the panel **308**. The front end **324** of each receptacle guide frame **322** is aligned with the opening in the panel **308**. The front end **324** of each receptacle guide frame **322** is positioned behind the panel **308**. The front end **324** of each receptacle guide frame **322** is accessible through the opening in the panel **308**.

Each receptacle guide frame **322** includes a receptacles **332** receptacles **332** receptacle **332** extending between the front end **324** and the back end **326** of the receptacle guide frame **322**. The receptacles **332** include an open end **334** positioned at the front end **324** of the receptacle guide frame **322**. The receptacles **332** include a closed end **336** positioned at the back end **326** of the receptacle guide frame **322**. The open end **334** of each receptacle **332** is aligned with the opening in the panel **308** so that the open end **334** of each receptacle **332** is accessible through the opening in the panel **308**.

The front ends **324** of the receptacle guide frames **322** are arranged in a stepped configuration. The back end **226** of each receptacle guide frame **322** is likewise arranged in a stepped configuration. The front end **324** of each receptacle guide frame **322** extends in a plane **338**. The plane **338** defined by each receptacle guide frame **322** is parallel to the plane **338** defined by the other receptacle guide frames **322**. The plane **338** defined by each receptacle guide frame **322** extends parallel to the outer edge **306** of the host board **302** and the panel **308**.

Each receptacle guide frame **322** includes a central axis C_3. The central axis C_3 extends between the front end **324** and the back end **326** of the receptacle guide frame **322**. The central axes C_3 extend at a non-orthogonal angle A_{10} with respect to the outer edge **306** of the host board **302** and the panel **308**. The central axes C_3 of the receptacle guide frames **322** are angled with respect to the panel **308** and the outer edge **306** of the host board **302** to facilitate cable management when connecting cables to the receptacle guide frames **322**.

The electrical assemblies **100**, **200**, and **300** are configured to be utilized in equipment racks that may include multiple electrical assemblies **100**, **200**, and **300**. The equipment racks may use any combination of electrical assemblies **100**, **200**, and **300**. The electrical assemblies **100**, **200**, and **300** include angled receptacle guide frames to facilitate cable management when coupling peripheral devices to the connectors. The receptacle guide frames are angled so that the cables coupled to an electrical assembly do not block the receptacle guide frames and/or light pipes of neighboring electrically assemblies.

It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments (and/or aspects thereof) may be used in combination with each other. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the various embodiments of the invention without departing from their scope. While the dimensions and types of materials described herein are intended to define the parameters of the various embodiments of the invention, the embodiments are by no means limiting and are exemplary embodiments. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the various embodiments of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects. Further, the limitations of the following claims are not written in means-plus-function format and are not intended to be interpreted based on 35 U.S.C. §112, sixth paragraph, unless and until such claim limitations expressly use the phrase "means for" followed by a statement of function void of further structure.

This written description uses examples to disclose the various embodiments of the invention, including the best mode, and also to enable any person skilled in the art to practice the various embodiments of the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the various embodiments of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if the examples have structural elements that do not differ from the literal language of the claims, or if the examples include equivalent structural elements with insubstantial differences from the literal languages of the claims.

What is claimed is:

1. A receptacle assembly comprising:

receptacle guide frames configured to be coupled to a host board, the receptacle guide frames having a common top cage and separator walls extending between a front end and a back end to define a plurality of receptacles adjacent to one another and ganged together, the common top cage spanning across each of the receptacles and the separator walls separating the adjacent receptacles; and

each receptacle extending from the front end to the back end, each receptacle having an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame, the receptacle guide frames extending through an opening in a panel so that the receptacles are accessible through the opening, the receptacles being angled at non-orthogonal angles relative to the panel; and

host board connectors positioned at the closed end of each corresponding receptacle, each host board connector including a mating face, wherein the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the panel.

2. The receptacle assembly of claim **1**, wherein each receptacle guide frame is elongated along a central axis extending from the front end to the back end of the receptacle guide frame, each receptacle guide frame aligned with the opening in the panel so that the central axis of each receptacle guide frame is positioned at a non-orthogonal angle with respect to the panel.

3. The receptacle assembly of claim **1**, wherein a plane is defined by the front end of each receptacle guide frame, the planes extending parallel to one another, wherein each receptacle guide frame is aligned with the opening in the panel so that the planes formed by the front end of each receptacle guide frame extend at a non-orthogonal angle with respect to the panel.

4. The receptacle assembly of claim **1**, wherein the top cage at the front end of each receptacle guide frame includes front edges, the front edges being non-contiguous and angled at non-orthogonal angles with respect to the panel.

5. The receptacle assembly of claim **1**, wherein the top cage includes at least one coupling mechanism extending therefrom proximate to the front end, the at least one coupling mechanism being positioned in the opening in the panel to directly electrically connect the top cage to the panel.

6. The receptacle assembly of claim **1**, wherein each of the receptacle guide frames includes a light pipe extending along the top cage above the associated receptacle, the light pipe having an end surface positioned in the panel.

7. The receptacle assembly of claim **1**, wherein each of the receptacle guide frames includes a light pipe extending along

the top cage above the associated receptacle, the light pipe having an end surface positioned flush with an outer surface of the panel.

8. The receptacle assembly of claim **1**, wherein each of the receptacle guide frames includes a light pipe extending along the top cage above the associated receptacle, the light pipe having an end portion extending perpendicular with respect to the panel.

9. The receptacle assembly of claim **1**, each of the receptacle guide frames includes a light pipe extending along the top cage above the associated receptacle, the light pipe having an end portion extending at an angle with respect to a central axis of the receptacle guide frame.

10. An electrical assembly comprising:

a host board having an outer edge configured to be positioned adjacent to a panel;

multiple receptacle guide frames arranged adjacent to one another and ganged together, the receptacle guide frames coupled to the host board, each receptacle guide frame having a front end and a back end, the receptacle guide frames having a common top cage and separator walls both extending between the front end and the back end to define a plurality of receptacles, the common top cage spanning across each of the receptacles and the separator walls separating the adjacent receptacles, the front ends of the receptacle guide frames being angled at non-orthogonal angles with respect to the outer edge of the host board;

each receptacle extending from the front end to the back end, each receptacle having an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame; and

a host board connector positioned at the closed end of each receptacle, each host board connector including a mating face, wherein each receptacle guide frame is coupled to the host board so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the outer edge of the host board.

11. The electrical assembly of claim **10**, wherein each receptacle guide frame is elongated along a central axis extending from the front end to the back end of the receptacle guide frame, each receptacle guide frame coupled to the host board so that the central axis of each receptacle guide frame is positioned at a non-orthogonal angle with respect to the outer edge of the host board.

12. The electrical assembly of claim **10**, wherein the receptacle guide frames comprise a bottom cage being shared by each of the receptacle guide frames, the separator walls extending between the top cage and the bottom cage to separate and define the receptacles.

13. The electrical assembly of claim **10**, wherein the front end of each receptacle guide frame is configured to be positioned behind an opening in the panel.

14. The electrical assembly of claim **10**, wherein the front end of the receptacle guide frame is configured to extend through an opening in the panel.

15. The electrical assembly of claim **10**, wherein at least one of the receptacle guide frames includes a light pipe extending therefrom, the light pipe having an end surface configured to be positioned flush with an outer surface of the panel.

16. The electrical assembly of claim **10**, wherein at least one of the receptacle guide frames includes a light pipe extending therefrom, the light pipe having an end portion extending perpendicular with respect to the outer edge of the host board.

17. The electrical assembly of claim **10**, wherein at least one of the receptacle guide frames includes a light pipe extending therefrom, the light pipe having an end portion extending at an angle with respect to a central axis of the receptacle guide frame.

18. An electrical assembly comprising:

a host board having an outer edge;

a panel positioned adjacent to the outer edge of the host board, the panel having an opening extending therethrough;

multiple receptacle guide frames arranged adjacent to one another and ganged together, the receptacle guide frames coupled to the host board, each receptacle guide frame having a front end and a back end, the receptacle guide frames including at least one coupling mechanism extending therefrom proximate to the front end, the at least one coupling mechanism being positioned in the opening in the panel to directly electrically connect the receptacle guide frames to the panel;

a receptacle extending from the front end to the back end of each receptacle guide frame, each receptacle having an open end positioned at the front end of the receptacle guide frame and a closed end positioned at the back end of the receptacle guide frame; and

a host board connector positioned at the closed end of each receptacle, each host board connector including a mating face, wherein each receptacle guide frame is coupled to the host board so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the panel.

19. The electrical assembly of claim **18**, wherein each receptacle guide frame is coupled to the host board so that the mating face of each host board connector is positioned at a non-orthogonal angle with respect to the outer edge of the host board.

20. The electrical assembly of claim **18**, wherein at least one of the receptacle guide frames includes a light pipe extending therefrom, the light pipe having an end surface configured to be positioned flush with an outer surface of the panel.

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